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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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GROUP 1700

Application Number: 10/758,381
Filing Date: January 15, 2004
Appellant(s): TEFFT ET AL.

K. Scott O'Brian
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed September 14, 2005 appealing from the Office action mailed April 26, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2003/0161946	MOORE ET AL	8-2003
5,958,522	NAKAGAWA ET AL	9-1999

Knight, R. and R.W. Smith, "HVOF Sprayed 80/20 NiCr Coatings -- Process Influence Trends", Thermal Spray: International Advances in Coatings Technology, Proceedings of the International Thermal Spray Conference 28 May --5 June 1992, Orlando Florida USA, 1992, pages159--164.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 12-17 and 19-24 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Moore et al (US 2003/0161946) in view of Knight, et al "HVOF Sprayed 80/20 NiCr Coatings--Process Influence Trends" (hereinafter Knight Article).

Claim 12: Moore teaches a method for forming a deposit on a deposition substrate. *Paragraphs [0018] – [0019].* A deposition gun is provided. *Paragraphs [0019] –*

[0020]. The gun can be an HVOF (high velocity oxy fuel) spray gun or other thermal spray gun. *Paragraphs [0019] – [0020]*. The gun can be provided with a flowing coolant. *Paragraph [0025]*. Moore teaches to provide a controller 15, which can include a computer and one or more microprocessors, configured to monitor (commonly understood to mean measure, sense, review) and control the components of the system. *Paragraph [0032]*. Moore further teaches that operation of all components of the system be substantially simultaneously controlled by the controller 15. *Paragraph [0032]*. Moore also teaches that operational aspects of the coating process, such as the flow rate of gases to the spray gun, the flow rate of the powder to the spray gun, the flow rate of the coolant flow through the spray gun (thus controlling the cooling capacity of the coolant flow), and other features may be controlled to produce a uniform coating with desired characteristics. *Paragraph [0033]*. Moore further provides that controller 15 can monitor the coating process using sensors to automatically adjust the operation to stay within selected coating parameters (or, in other words, set point) in a feedback control system in response to variations in temperature, fluctuations in coating process parameters, the rate of coating deposition or any other detectable variations. *See paragraphs [0033] – [0034]*.

Claim 14, 21: the coolant flow rate can be controlled by controller 15. *Paragraph [0033]*. As discussed, controller 15 can also monitor the coating process to automatically adjust the operation to stay within selected coating parameters in response to variations in the coating process. *Paragraph [0034]*.

Claim 16, 23: monitored features can be used to provide feedback to an operator for allowing the operator to make adjustments. *Paragraph [0034].*

Claim 17, 24: monitored features can be used to automatically adjust the operation to stay within desired parameters using a controller. *Paragraph [0034].*

Claim 19: Moore teaches the features as discussed in regard to claim 12 above. Furthermore, the coolant can be water. *Paragraph [0025].*

Moore teaches all the features of these claims except (1) various of the specific features that are measured and used for feedback control (claim 12-14, 19-21), (2) the features of the deposition/HVOF spray gun (claim 15, 17, 20, 24) and (3) the instrumentation array (claim 16, 23).

Knight Article teaches the use and testing of an HVOF (high velocity oxy fuel) spray deposition apparatus. *See page 159.* HVOF is taught to be a growing area of thermal spray coating technology. *Page 159.* Knight Article teaches that all current HVOF designs operate on similar principles, using a deposition gun that burns a mixture of fuel gas and an oxidizer (oxygen) to form a deposition gas flow, mixing a powder into the deposition gas flow to form a deposition mixture flow and project the deposition mixture flow therefrom. *See page 159.* The mixture of fuel and oxidizer is burned in a combustion chamber to provide a pressured deposition gas flow. *Page 159.* The powder in carrier gas flow is mixed with the pressured gas flow in a mixing area. *See page 159.* The mixing area can be downstream of the combustion chamber. *See page 159 (downstream of the combustion zone into the nozzle).* A deposition flow director

receives the deposition mixture and directs towards the substrate (the constricting nozzle). *Page 159.* The gun is taught as being provided with a flowing coolant, which would pas through a cooling structure. *Page 159 (air or water).* Knight Article teaches that important variables for HVOF coating include fuel and oxygen ratio, pressure and total flow; the feed rate (flow rate) of the powder; and the coolant medium features, including temperature and flow rate. *See page 159.* Knight Article goes on to provide an investigation of the influence of variations in key process parameters. *See last paragraph, page 159.* The investigated key process parameters are surface speed of the part, spray distance and fuel:oxygen ratio. *Page 160 (after Table 1).*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Moore to specifically additionally monitor and control the flow rate of the fuel, oxidizer, and powder, and the flow rate and temperature of the coolant flow and use an HVOF gun structure as suggested by Knight Article in order to provide an optimum final coating product, because Moore teaches coating using an HVOF spray gun system and to monitor various parameters (including all components and any detectable variations in the coating process) of the spray system and provide feedback control to keep these parameters at optimum positioning, and Knight Article teaches that known variables when coating with an HVOF gun system include the flow rate of the fuel, oxidizer, and powder, and the flow rate and temperature of the coolant flow and conventional features of such a HVOF gun. Furthermore, it would further have been obvious to modify Moore in view of Knight Article to provide an

instrumentation array showing the measurements of these features (flow rate of fuel, oxidizer, powder and cooling capacity) in order to provide a desirable adjustment of the features, because Moore teaches that the controller for monitoring the coating process can provide feedback to an operator for making adjustments, which would indicate to one of ordinary skill in the art that some type of instrumentation array would be needed to show results of the measured features and allow adjusting. Furthermore, it would further have been obvious to modify Moore in view of Knight Article to provide an automatically controllable fuel source, oxidizer source, powder and coolant source, in order to provide a desirable adjustment of the features, because as shown by Moore and Knight Article, an~~d~~ HVOF gun system needs a source of fuel, oxidizer, powder and coolant and further suggests to monitor and control various parameters (including all components and any detectable variations in the coating process) of the spray system, and Moore teaches that the controller for monitoring the coating process can be used to provide automatic adjustments, which would indicate that the materials to be supplied would need a supply system that allows automatic control of the materials to be provided.

2. Claims 18 and 25 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Moore in view of Knight Article as applied to claims 12-17 and 19-24 above, and further in view of Nakagawa et al (US 5958522).

Moore in view of Knight Article teaches all the features of these claims except the fuel to oxidizer ratio of 2.2-2.6. Knight Article does teach that for the HVOF system the fuel gas can be hydrogen and the oxidizer can be oxygen. *Page 159.*

However, Nakagawa teaches a process for high speed thermal spray coating where a high speed flame is produced from combustion gas and a thermal spray coating material powder is sprayed using this high speed flame. *Column 1, lines 5-15.* Nakagawa teaches that the system includes a combustion flame that is injected under high temperature and pressure to form an ultra high speed flame. *Column 3, lines 45-60.* The coating material is carried by an inert gas and injected into the combustion flame and then accelerated out the spray gun onto a substrate. *Column 3, lines 45-60.* When performing this high speed flame spraying, the combustion can be a mixture of oxygen and fuel gas (such as hydrogen, propane, ethylene, kerosene, etc.). *Column 6, lines 5-10.* The flame speed can be greater than 1000 m/sec, up to 2500 m/sec. *Column 6, lines 15-20.* When the fuel gas is hydrogen and the oxidizer is oxygen, a desirable ratio of hydrogen to oxygen is 2.0:1 to 2.6:1. *Column 6, line 55 through column 7, line 5.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Moore in view of Knight Article to use a hydrogen:oxygen ratio as suggested by Nakagawa in order to provide an optimum final coating product, because Moore in view of Knight Article teaches coating using an HVOF spray gun system and that the fuel can be hydrogen and the oxidizer can be oxygen, and Nakagawa teaches when performing high speed flame spraying with a

hydrogen fuel and oxygen oxidizer, a desirable hydrogen:fuel ratio can be 2.6:1, for example.

(10) Response to Argument

Issue 1: The rejection of Claims 12-17 and 19-24 under 35 USC 103 using Moore in view of Knight Article

(A) Appellant initially argues, at page 5 of the Appeal Brief, that Moore fails to teach key features of the present approach, including the specific features measured and used for feedback control, the features of the HVOF spray gun and the instrumentation that is used to perform the measurements of the process parameters. Appellant further argues, at pages 5-6 of the Appeal Brief, that Moore fails to teach controlling the process parameters of the deposition gun based upon measurements of those same process parameters. While paragraph [0034] of Moore refers to controller 15 monitoring the coating process using sensors, the described "sensors" of Moore in paragraph [0028] sense coating parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating /substrate and coating thickness; not gas flows, powder flows, and/or coolant flows, according to appellant. Moore, appellant argues, never suggests measuring gas flow rates, powder flow rates, and cooling capacity of the deposition gun, and then controlling the deposition gun responsive to these measurements. As to Knight Article teaching the missing elements, appellant argues that Knight Article does not provide measurement

and responsive set point controlling based on these measurements, rather at page 159, Knight Article mentions some parameters that may be fixed. Knight Article provides at page 160, that three key parameters are set to specific nominal values for each test and that all other parameters remain constant at baseline values. According to appellant, Knight Article never suggests that any parameters are measured and then used as the basis for controlling the deposition process. Appellant argues that merely because a parameter is controlled, it is not necessarily measured and used to control the parameter in a feedback manner. According to appellant, while the Examiner argues that because Moore says to control gas flow rate there is an implication that Moore measures gas flow rate with the sensors, this not correct, as Moore measures different features as discussed above. Appellant further argues that the process control approach of Knight Article is contrary to Moore, because Moore teaches that properties of the coatings are measured and used in control and Knight Article provides at only three parameters are varied and all else is constant, and that one of ordinary skill would reading the two references would not know whether to follow the control approach of Moore or that of Knight Article, and also that both approaches differ from the presently claimed approach. According to appellant, prima facie obviousness is not present as all limitations are not taught.

The Examiner has reviewed these arguments, however, the rejection is maintained. Initially as to the extent of the monitoring and control suggested by Moore, the Examiner notes that this is primarily discussed in paragraphs [0032] – [0034] of

Moore. At paragraphs [0032] – [0033], Moore teaches that controller 15 is used to monitor (e.g., measure, sense, review) and control the components of system and that all of the components of the system are simultaneously controlled by the controller; and further that the controller also controls operational aspects of the coating process, such as the flow rate of gases and powder to the spray gun, the flow rates of coolant fluid, etc. Then at paragraph [0034], Moore teaches that controller 15 may monitor the coating process using the previously discussed sensors and automatically adjust the operation to stay within selected coating parameters in response "to variations in temperature, fluctuations in coating process parameters, the rate of coating deposition or any other detectable variations in the coating process". Thus, it appears that Moore provides monitoring with feedback control of any "fluctuations in coating process parameters" or "any other detectable variations in the coating process". Appellant argues that the "sensors" of Moore would not provide for measurement of gas flow rates, powder flow rates and cooling capacity, because the "sensors" of paragraph [0028] of Moore do not provide for such measurements. However, a reading of paragraph [0028] does not indicate that Moore is limited <u>only</u> to the sensors described. For example, the paragraph states "Additional sensors may include . . . " or "Other sensors could include . . .". Thus, when Moore teaches at paragraph [0034] that automatic adjustment can occur in response to "fluctuations in coating process parameters" or "any other detectable variations in the coating process", the question becomes would it be obvious to provide sensing and feedback control of other known coating process parameters

beyond those specifically listed by Moore. It is the Examiner's position that it would be obvious, given the open ended teaching by Moore of performing monitoring and feedback control adjustments based on the general statements "fluctuations in coating process parameters" or "any other detectable variations in the coating process". The Examiner has provided Knight Article to indicate the standard structural set up of a HVOF spray gun system, and common "variables" or "process parameters" used in the HVOF spray gun system. Knight Article teaches that variables in the HVOF system include fuel and oxygen ratio, pressure and total flow; the feed rate (flow rate) of the powder; and the coolant medium features, including temperature and flow rate (page 159). Knight Article alone does not teach to perform measurement and feedback control using these coating process variables, rather it is the combination of Moore and Knight Article that provides such a suggestion. Moore teaches to perform monitoring and feedback control adjustments based on "fluctuations in coating process parameters" or "any other detectable variations in the coating process" of an HVOF spray process, and Knight Article provides that gas flow rates, powder flow rates and coolant features are specifically known variables/process parameters of an HVOF spray process, and thus, to one of ordinary skill in the art these claimed variables would be process parameters it would be suggested to monitor for fluctuations or variations. While Knight Article does specific testing with only some parameters, this does not negate the initial teaching and listing of generally conventionally known variables in an HVOF process.

As to the argument that Knight Article's control approach is contrary to that of Moore, the Examiner disagrees. After discussing the standard features of an HVOF spray system and known variables in such a spray system, Knight Article goes on to perform a specific testing process at pages 160+ that analyzes the spraying of NiCr coatings with specific variations of selected parameters, indicating that as various parameters changed, the resulting coating changes. This does not provide a teaching away from Moore. One of ordinary skill in the art would not find that a description of test methodology as provided in Knight Article, where specific variables are intentionally adjusted to see what changes occur (that is, to determine what parameters provide a desired coating) to suggest to one of ordinary skill in the art that when providing a coating for commercial use as taught by Moore where the desire is to provide a uniform coating, that one would provide changing conditions as taught in the tests of Knight Article. In fact, Knight Article teaches towards the process of Moore, by demonstrating that when variables are changed, the coating result changes, and by showing testing to determine how these variables and changes in the variables affect the resultant coating. Moore teaches to prevent undesired changes so that a uniform coating will occur, by performing the monitoring and control so as to "automatically adjust the operation to stay within selected coating parameters" (paragraph [0034]), and these selected coating parameters would be desired ranges determined by testing procedures such as shown by Knight Article. Thus, as discussed above, and in the

Grounds of Rejection, all the features as claimed are taught or suggested by the combination of Moore and Knight Article.

(B) Claims 12 and 19

Appellant further argues, at pages 7-8 of the Appeal Brief, that the cited references do not provide the claimed requirement of the "measuring a flow rate of the fuel to the deposition gun, a flow rate of the oxidizer to the deposition gun, a flow rate of the powder to the deposition gun, and a cooling capacity of the coolant flow". According to appellant, Moore has no teaching of this limitation, and Knight Article does not provide this limitation, because while Knight Article teaches that certain parameters may be variables, there is no teaching that they are measured or that fuel flow rate and oxygen flow rate are even of interest (only the ratio is mentioned). Furthermore, appellant argues, in the testing on page 160, Knight Article provides that only three parameters were varied, and all others were fixed at baseline values, and no mention is made of flow rates of fuel, oxidizer, and powder and cooling capacity as being important parameters to be measured or controlled. Furthermore, appellant argues that claims 12 and 19 further require "set-point" controlling the parameters "all responsive to the step of measuring", and that the references do not have such teaching. Appellant argues that paragraph [0028] of Moore provides parameters that may be used as the basis for feedback control, and that flow rates of fuel, oxidizer, powder or cooling capacity are not among them. Knight Article does not mention any type of set point controlling, but rather sets parameters at particular values and leaves them set.

According to appellant, neither reference points the way to the measurement of specific recited process parameters of the deposition gun and active control of any of these same process parameters recited in the present claims. Appellant further argues that paragraph [0029] of the present specification presents a direct experimental comparison between the present approach and the closest prior art, producing surprising and unexpected improvements in the performance of the sprayed coatings.

The Examiner has reviewed these arguments, however, the rejection is maintained. While Moore does not teach the specific measurement of the flow rate of the fuel to the deposition gun, flow rate of the oxidizer to the deposition gun, flow rate of the powder to the deposition gun, and a cooling capacity of the coolant flow, it is the combination of the references to Moore and Knight Article that provide the suggestion to perform the claimed measurements. As fully discussed in section (A) above, Moore teaches to perform monitoring and feedback control adjustments based on "fluctuations in coating process parameters" or "any other detectable variations in the coating process" of an HVOF spray process, and Knight Article provides that gas flow rates, powder flow rates, and coolant features are specifically known variables/process parameters of an HVOF spray process, and thus, to one of ordinary skill in the art these claimed variables to be measured would be process parameters that would be suggested to be monitored for fluctuations or variations. As to the citation of the "ratio" of fuel flow rate and oxygen flow rate in Knight Article, rather than the individual fuel flow rate and oxygen flow rate, it is the Examiner's position that it

would be clear to one of ordinary skill in the art that the individual fuel and oxygen flow rates would be measured in order to check on the "ratio" since this is what is shown at Table 1 and page 160 of Knight Article (note that the fuel flow rate and oxygen flow rate are shown at Table 1, and then, after Table 1, the changing of the fuel:oxygen ratio is discussed while keeping total gas flow constant). As fully discussed and addressed in section (A) above, as to the testing process of Knight Article at pages 160+ not performing the measurements as claimed, the testing process of Knight Article does not teach against the combination with Moore.

As to the experimental comparison at paragraph [0029] of the present specification, the Examiner has reviewed this comparison, however, the comparison is to the use of a D-gun deposition (a different application process) or to the present gun without a deposition controller. The Examiner does not find that it shows unexpected benefits over the rejection of Moore in view of Knight Article, because the primary reference to Moore clearly teaches that a controller should be used.

(C) Claims 13 and 20

Appellant argues, at page 8 of the Appeal Brief, that neither reference has a teaching of the claimed "measuring a coolant temperature of the coolant flow", as Moore at paragraph [0028] does not provide a parameter of coolant temperature measurement and Knight Article never suggests measuring coolant temperature. Appellant argues that the explanation of rejection never addresses these claims and this limitation, presumably conceding that the reference does not teach this limitation.

The Examiner has reviewed this argument, however, the rejection is maintained. Knight Article at page 159 specifically teaches that a known variable is coolant temperature, citing "Since both water and air-cooled HVOF guns have been developed the flow rate and temperature of the cooling media also affects the flame temperature and characteristics of the coating produced". Moore also teaches that coolant conditions affect the coating at paragraph [0033] noting that an operational aspect of the coating process includes "the flow rates of coolant fluid through the cooling systems". As to the desire to measure the coolant temperature of the coolant flow, the Examiner notes that as discussed in section (A) above, Moore teaches to perform monitoring and feedback control adjustments based on "fluctuations in coating process parameters" or "any other detectable variations in the coating process" of an HVOF spray process, and Knight Article provides that coolant features, such as coolant temperature are specifically known variables/process parameters of an HVOF spray process, and thus, to one of ordinary skill in the art desired process parameters that would be suggested to be monitored for fluctuations or variations would include the coolant temperature. This limitation was specifically addressed in the **Grounds of Rejection** above as well, as it was indicated that it "would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Moore to specifically additionally <u>monitor</u> and control the flow rate of the fuel, oxidizer, and powder, and the flow rate and <u>temperature of the coolant flow</u> and use an HVOF gun structure as suggested by Knight Article in order to provide an optimum final coating product . . ." (emphasis added).

(D) Claims 14 and 21

Appellant argues, at page 9 of the Appeal Brief, that neither reference has a teaching of the claimed "measuring a coolant flow rate of the coolant flow", as Moore never suggests measuring a coolant flow rate and then controlling the deposition gun responsive to that measurement, rather coating parameters that Moore measures as described at paragraph [0028] does not provide a parameter of coolant flow measurement and at paragraph [0033] Moore speaks of controlling the coolant flow rate, but not measuring the coolant flow rate and Knight Article never suggests measuring coolant temperature. Appellant argues that it is important to distinguish between what is controlled as compare to what is measured and controlled based on the measured value.

The Examiner has reviewed this argument, however, the rejection is maintained. Moore, at paragraph [0033], teaches that an operational aspect of the coating process that is controlled is "the flow rates of coolant fluid through the cooling system". Moreover, at paragraph [0032] Moore teaches to use the controller 15 to monitor (commonly understood to mean measure, sense, review) and control the components of the system and also discusses monitoring at paragraph [0034] as discussed in section (A) above. Knight Article at page 159 specifically teaches that a known variable is coolant flow rate, citing "Since both water and air-cooled HVOF guns have been developed the flow rate and temperature of the cooling media also affects the flame temperature and characteristics of the coating produced". As to the desire to measure

the coolant flow rate of the coolant flow, the Examiner notes that as discussed in section (A) above, Moore teaches to perform monitoring and feedback control adjustments based on "fluctuations in coating process parameters" or "any other detectable variations in the coating process" of an HVOF spray process, and Knight Article provides that coolant features, such as coolant flow rates are specifically known variables/process parameters of an HVOF spray process, and thus, to one of ordinary skill in the art a process parameter that would be suggested to be monitored for fluctuations or variations would be the variable of coolant flow rate. This limitation was specifically addressed in the **Grounds of Rejection** above as well, as it was indicated that it "would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Moore to specifically additionally <u>monitor</u> and control the flow rate of the fuel, oxidizer, and powder, and the <u>flow rate</u> and temperature <u>of the coolant flow</u> and use an HVOF gun structure as suggested by Knight Article in order to provide an optimum final coating product . . ." (emphasis added).

(E) Claims 15 and 22

Appellant argues, at pages 9-10 of the Appeal Brief, that neither reference describes the claimed structural details of the deposition device. According to Appellant, while Knight Article describes some apparatus features, there is no reason to believe that Moore contemplates such an apparatus or that the control approach of Moore would be used with such an apparatus, and the fact that such an apparatus

exists does not suggest that the approach of Moore would be operable with that apparatus.

The Examiner has reviewed this argument, however, the rejection is maintained. Moore, at paragraph [0020], teaches that the spray gun 14 to be used can be "any spray gun useful for spraying coatings, as known to those skilled in the art", and that "Examples include . . . thermal spray guns. . .". Moore goes on to state in paragraph [0020] that "Suitable thermal spray guns include . . . high velocity oxy fuel spray guns . . ." Thus, Moore clearly indicates that an HVOF (high velocity oxy fuel) spray gun can be used. Knight Article, at page 159 teaches apparatus features of the HVOF spray gun, including the claimed combustion chamber, mixer, deposition flow director and cooling structure (see the **Grounds of Rejection** above), and further teaches that ". . . all current HVOF designs operate on similar principles. . ." (page 159). Since Moore teaches that a variety of spray guns can be used, including an HVOF spray gun, and Knight Article teaches the specific apparatus features of the HVOF spray gun (including apparatus features those claimed by appellant), and that all current HVOF designs operate on similar principles, it would be abundantly clear to one of ordinary skill in the art that the process of Moore would be expected to work with a HVOF spray gun as described by Knight Article.

(F) Claims 16 and 23

Appellant argues, at page 10 of the Appeal Brief, that as to the claimed instrumentation array features, the explanation of the rejection is correct that Moore

teaches "some type of instrumentation array". However, according to appellant, this array is described in Moore in paragraph [0028], as including sensors for measuring coating parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness; and neither Moore nor Knight Article ever suggest measuring gas flow rates, powder flow rates, and cooling capacity, and then controlling the deposition gun responsive to those measurements.

The Examiner has reviewed these arguments, however, the rejection is maintained. It remains the Examiner's position that it would further have been obvious to modify Moore in view of Knight Article to provide an instrumentation array showing the measurements of these features of claims 16 and 23 (flow rate of fuel, oxidizer, powder and cooling capacity) in order to provide a desirable adjustment of the features, because Moore teaches that the controller for monitoring the coating process can provide feedback to an operator for making adjustments, which would indicate to one of ordinary skill in the art that some type of instrumentation array would be needed to show results of the measured features and allow adjusting. As to the argument that the array in Moore would only describe the features as shown in the paragraph [0028], and that the references do not suggest the measuring of gas flow rates, powder flow rates, and cooling capacity, and then controlling the deposition gun responsive to these measurements, the Examiner maintains her position as discussed in section (A) above, that the combination of the references suggests the measurements of gas flow rates,

powder flow rates, and cooling capacity, and then controlling the deposition gun responsive to these measurements. Please note the full discussion in section (A) above.

(G) Claims 17 and 24

Appellant argues, at pages 10-11 of the Appeal Brief, that neither reference teaches, for example, "a controllable fuel source of the fuel communicating with the combustion chamber, wherein the controllable fuel source is automatically controlled responsive to the fuel measurement", as neither reference teaches a fuel measurement, so there is no controllable fuel source that can be controlled responsive to a fuel measurement. Appellant further argues that paragraph [0026] of the present specification indicates the need for the feedback control system, and paragraph [0029] of the present specification presents a direct experimentation comparison between the present approach and the closed prior art, indicated surprising and unexpected benefits.

The Examiner has reviewed these arguments, however, the rejection is maintained. As to the fuel measurement, as discussed and addressed in sections (A) and (B) above, it is the Examiner's position that Knight Article, which is properly combinable with Moore, teaches the known variable of fuel and oxygen ratio (page 159), and as shown on page 160, the need to individually record the fuel flow rate. As to the automatic control, as discussed in the **Grounds of Rejection** above, it would further have been obvious to modify Moore in view of Knight Article to provide an automatically controllable fuel source, oxidizer source, powder and coolant source, in

order to provide a desirable adjustment of the features, because as shown by Moore and Knight Article, and HVOF gun system needs a source of fuel, oxidizer, powder and coolant and Moore and Knight Article, in combination, further suggests to monitor and control various parameters (including all components and any detectable variations in the coating process) of the spray system, and Moore teaches that the controller for monitoring the coating process can be used to provide automatic adjustments, which would indicate that the materials to be supplied would need a supply system that allows automatic control of the materials to be provided.

As to paragraph [0026], the Examiner notes that Moore also provides the benefit of feedback control. As to the experimental comparison at paragraph [0029] of the present specification, the Examiner has reviewed this comparison, however, the comparison is to the use of a D-gun deposition (a different application process) or to the present gun without a deposition controller. The Examiner does not find that it shows unexpected benefits over the rejection of Moore in view of Knight Article, because the primary reference to Moore clearly teaches that a controller should be used.

(H) Appellant further argues as to all the claims, (1) at pages 11-13 of the Appeal Brief, that to provide a proper sec. 103 combination rejection requires more than just findings of teaching in the references of the elements recited in the claim (but which was not done here), objective motivation to combine the references must also be shown, which was not done here. Rather, according to appellant, the paragraph bridging pages 4-5 of the Final Office Action presents a hindsight rationale for measuring and

controlling various parameters. (2) Appellant further argues, at pages 13-14 of the Appeal Brief, as to page 7+ of the Final Office Action, that the Examiner takes the position that neither reference teaches the specific claim limitations discussed above, and the reference in Moore to controlling "all the components" means that the physical components are controlled (and "components" are not "process variables"), with the references to "coating process parameters" all to measurable parameters of the coated article, with no suggestion of measuring and controlling parameters related to the inputs to a deposition device. Furthermore, that individual fuel flow rate and oxygen flow rates may vary has no relation to the teaching of the measurement of the ratio of fuel flow rate to oxygen flow rate. Appellant argues that Knight Article does not aid the case of the rejection as it identifies three spray parameters that are not mentioned by Moore, and that Knight Article goes on to teach that "all other parameters were fixed at the baseline values". Appellant states "If the Examiner has any way to reconcile these contrary teachings of Moore and Knight, Applicant asks that it be set forth in the Examiner's Answer. Otherwise, Applicant will take it as admitted that the two references teach contrarily to each other, with completely disjoint sets of parameters to be controlled." (3) Appellant further argues, at page 14 of the Appeal Brief, regarding claims 13-14, these claims recite "measuring" recited parameters, and Moore teaches "controlling" parameters, but makes no mention of "measuring" these parameters. (4) Appellant further argues, at page 14 of the Appeal Brief, regarding claim 15, the Response suggests that various recited components are taught by Knight Article, but

they are simply not disclosed, except for the combustion chamber. (5) Appellant further argues, at page 14 of the Appeal Brief, regarding claims 16-17, that the Examiner has asserted that the recited features are present in the teachings of the references, but that does not cause them to actually be present. Appellant states that "Absent specifically pointing out where the recited features are said to be taught in the references, Applicant will take it as admitted that they are not taught by the references." (6) At page 14 of the Appeal Brief, appellant argues that regarding the combination of references, neither of the Office Actions provides a reconciliation of the directly contrary teachings of the two references. (7) At pages 14-15 of the Appeal Brief, appellant argues that they performed experimental comparisons that demonstrated the surprising and unexpected advantages of the present approach over the closest prior art at paragraph [0029] of the specification.

The Examiner has reviewed these arguments, however, the rejection is maintained. As to argument (1) regarding the motivation to combine the references, the Examiner takes the position that motivation to combine the references is thoroughly addressed in section (A) above. In response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)

and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, motivation to combine can be found in knowledge generally available to one of ordinary skill in the art, as Moore is concerned with monitoring various features of the spray system, and Knight Article teaches various variable features of the spray system, and thus, features that would desirably be subject to monitoring and control. As to appellant's arguments as to (2) the controlling all the components in Moore, the Examiner notes that as discussed and addressed in section (A) above, Moore provides monitoring with feedback control any "fluctuations in coating process parameters" or "any other detectable variations in the coating process". In paragraph [0033] of Moore it is indicated that "Operational aspects of the coating process, such as the flow rate of gases and powder to the spray gun 14, the flow rates of coolant fluid through the cooling systems... and others may be controlled". A reading of these statements clearly indicates that "coating process parameters" and "detectable variations in the coating process" would include parameters other the those concerned with measuring of the coated article only. As discussed above, in section (A) the combination of Moore with Knight Article (which provides variables in an HVOF coating process) provides the suggestion of modifying Moore to specifically measure the variables described in Knight Article. As to the individual fuel flow rate and oxygen flow rate monitoring, the suggestion to do so has been specifically discussed in section (B) above. As to the reconciling of the contrary teachings of Moore and Knight Article, this has been thoroughly discussed in section (A) above. As to appellant's arguments (3) regarding

claims 13-14, the Examiner notes that this issue was discussed and addressed in section (A) above, where the Examiner discussed both controlling and measuring. As to appellant's arguments (4) regarding claim 15, the Examiner notes that this issue was discussed in section (E) above, where the Examiner discussed the support for the structural components. As to appellant's arguments (5) regarding claims 16-17, the Examiner notes that these issues were discussed in sections (F) and (G) above, and the motivation for providing the claimed features is discussed there and in the **Grounds of Rejection**. As to appellant's statement that "Absent specifically pointing out where the recited features are said to be taught in the references, Applicant will take it as admitted that they are not taught by the references", the Examiner takes the position that as discussed in sections (F) and (G) and in the **Grounds of Rejection**, all the features of these claims are taught or suggested by the combination of the references. As to appellant's arguments (6) as to the reconciliation of the contrary teaching of the references, this is fully discussed and addressed in section (A) above. As to appellant's arguments (7) as to the experimental comparison, the Examiner notes that this was fully discussed and addressed in section (B) above, where the Examiner noted that as to the experimental comparison at paragraph [0029] of the present specification, the Examiner has reviewed this comparison, however, the comparison is to the use of a D-gun deposition (a different application process) or to the present gun without a deposition controller. The Examiner does not find that it shows unexpected benefits over the

rejection of Moore in view of Knight Article, because the primary reference to Moore clearly teaches that a controller should be used.

Issue 2: The rejection of claims 18 and 25 under 35 USC 103 using More in view of Knight Article further in view of Nakagawa

Appellant first argues, at page 15, that the limitations of the parent claims are not taught by Moore in view of Knight Article and Nakagawa adds nothing in this regard. Appellant then argues, at page 15, that Moore has no teaching that its approach is operable with hydrogen/oxygen and no teaching that its various control features are operable with hydrogen/oxygen fuel/oxidizer. Appellant further argues that Nakagawa is nonanalogous art, as Moore and Knight Article deal with HOVF process, and Nakagawa deals with thermal spray, not HVOF. It also appears that Nakagawa does not have the claimed deposition gun features as in parent claims 12 and 18, according to appellant. At pages 15-16, appellant further argues that in the Final Office Action, pages 10-11, the Examiner addresses the shape of the device of Nakagawa as compared to the shape of the device of Knight Article. Appellant argues that the shape of the devices is not relevant, rather that they function in a similar manner, which they do not. Further, appellant argues, there is no evidence that different types of deposition devices are "equivalents" are that different fuel/oxidizer types are "equivalents" in respect to a hydrogen/oxygen ratio, particular in view of Knight Article's statement at page 160 that different types of fuels are not equivalent.

The Examiner has reviewed these arguments, however, the rejection is maintained. As to the limitations in the parent claims, as discussed with regard to **Issue 1** above, it remains the Examiner's position that the features of the parent claims are suggested by the combination of Moore and Knight Article. As to the teaching of Moore with regard to the use of hydrogen as the fuel and oxygen as the oxidizer for the spraying system, the Examiner notes that Moore does not teach the specific fuel and oxygen gases. However, Moore does teach that the spray gun can be selected from thermal spray gun systems, including plasma spray guns, high velocity oxy fuel (HVOF) spray guns, flame spray guns, etc. (paragraph [0020]). Moreover, Knight Article teaches that for HVOF spray systems, the fuel gas can be hydrogen (see page 159 and 160) and that oxygen can be the oxidizer (see page 159 and 160). Since Moore teaches the use of HVOF spray guns and Knight Article teaches that fuel/oxidizer for HVOF spray systems can desirably be hydrogen/oxygen, it would have been obvious to use hydrogen/oxygen in the system of Moore with an expectation of a desirable spraying, as Knight Article teaches a desirable fuel/oxidizer combination for HVOF spraying. As to the argument that Nakagawa is non-analogous art, the Examiner disagrees. In response to appellant's argument that Nakagawa is nonanalogous art, it has been held that a prior art reference must either be in the field of appellant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In

this case, Nakagawa is in the field of appellant's endeavor. While Nakagawa does not specifically indicate that the fuel/oxidizer is taught for an HVOF system, it is taught for a high speed thermal spray coating method, where a high speed flame is produced from a combustion gas (column 5, lines 5-10). As shown by Moore, HVOF is a type of thermal spraying. Moreover, the spraying in Nakagawa is produced by using various combinations of oxygen and other fuel gases, including hydrogen, to generate a high speed flame having a flame speed of 1000-25000 m/second and a flame temperature of 2200 to 3000 degrees C (column 2, lines 50-65). Nakagawa also shows shock diamonds in the in efflux (see the diamonds in figure 1). These high speed thermal spraying conditions overlap with the conditions of HVOF taught by Knight Article at page 159, where the exhaust flow can attain velocity of approximately 1700 m/s, with visible shock diamonds in the efflux and flame temperature of approximately 3000 degrees C. As a result, Nakagawa is clearly concerned with a thermal spraying process that produces conditions overlapping with HVOF spraying. As a result, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Moore in view of Knight Article to use a hydrogen:oxygen ratio as suggested by Nakagawa in order to provide an optimum final coating product, because Moore in view of Knight Article teaches coating using an HVOF spray gun system and that the fuel can be hydrogen and the oxidizer can be oxygen, and Nakagawa teaches when performing high speed flame spraying with a hydrogen fuel and oxygen oxidizer, a desirable hydrogen:fuel ratio can be 2.6:1, for example.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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